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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/824,751

**Applicant(s)**

DUSSUD, PATRICK H.

**Examiner**

Arpan P. Savla

**Art Unit**

2185

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 August 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-12, 14 and 17-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12, 14 and 17-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/S508)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### **Continued Examination Under 37 CFR 1.114**

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 26, 2008 has been entered.

### **Response to Amendment**

This Office action is in response to Applicant's communication filed August 26, 2008 in response to the Office action dated April 16, 2008. Claims 1-2 and 14 have been amended. Claims 1-12, 14, and 17-24 are pending in this application.

## **REJECTIONS NOT BASED ON PRIOR ART**

### **Claim Rejections - 35 USC § 101**

1. In view of Applicant's amendment, the 101 rejection of claims 1-12 is withdrawn.

## **REJECTIONS BASED ON PRIOR ART**

### **Claim Rejections - 35 USC § 103**

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**3. Claims 1-12, 14, and 17-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dussud (U.S. Patent 6,502,111) in view of Applicant's admitted prior art (hereinafter "AAPA").**

4. **As per claim 1**, Dussud discloses a computer-readable storage medium apparatus having computer-executable instructions for performing ephemeral garbage collection, the computer readable storage medium being accessible by a computing device (col. 14, lines 26-35), the instructions comprising:

requesting a list from a tracking mechanism (col. 5, lines 50-51; Fig. 1, element 32), the list identifying a plurality of memory locations that have been accessed since a last ephemeral garbage collection (col. 5, lines 42-45; col. 6, lines 34-44), each memory location corresponding to one of a plurality of cards associated with a card table, wherein the card table identifies one or more of the plurality of cards with one or more objects that have been accessed, each of the plurality of cards being associated with the one or more objects allocated from within a memory heap (col. 5, line 64 – col. 6, line 1; Fig. 1, elements 34 and 36a-36i; col. 9, lines 3-9). *It should be noted that the "write watch module" is analogous to the "tracking mechanism", the "array of memory locations" is analogous to the "list", each set of "memory objects" (i.e. 36a-36i) is analogous to a "card", and the "bit map" is analogous to the "card table."*

and performing garbage collection upon the at least one accessed object (col. 11, lines 42-53; Fig. 4, element 318).

Dussud does not disclose creating a bundle table containing entries identifying a plurality of bundles, wherein each of the plurality of bundles identifies groupings of subsets of the plurality of cards;

marking two or more of the plurality of bundles identified in the bundle table using the list, wherein the marked bundles identify groupings of subsets of the plurality of marked cards having associated objects that have been accessed since a last garbage collection process;

for each marked bundle identified in the bundle table, determining at least one marked card in a grouping of subsets of the plurality of marked cards identified by the marked bundle;

for each determined marked card, determining at least one accessed object within associated with the marked card;

AAPA discloses creating a bundle table containing entries identifying a plurality of bundles, wherein each of the plurality of bundles identifies groupings of subsets of the plurality of cards (paragraph 0007); *It should be noted that the "bundle bit map" is analogous to the "bundle table."*

wherein the marked bundles identify groupings of subsets of the plurality of marked cards having associated objects that have been accessed since a last garbage collection process (paragraph 0007); *It should be noted that a "card" which has been "accessed" is analogous to a "marked card."*

for each marked bundle identified in the bundle table, determining at least one marked card in a grouping of subsets of the plurality of marked cards identified by the marked bundle (paragraph 0007);

for each determined marked card, determining at least one accessed object within associated with the marked card (paragraph 0007);

Dussud and AAPA are analogous art because they are from the same field of endeavor, that being garbage collection systems.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to apply AAPA's card table/bundle garbage collection process, a known technique, to Dussud's concurrent garbage collection, a known system ready for improvement, such that the combined garbage collection system would mark two or more of the plurality of bundles identified in the bundle table of AAPA using Dussud's list, so as to yield the predictable results of improving the efficiency of ephemeral garbage collection as well helping minimize the dependency of ephemeral garbage collection on heap size.

5. **As per claim 2**, the combination of Dussud/AAPA discloses the tracking mechanism comprises a write-watch mechanism (Dussud, col. 5, lines 50-51; Fig. 1, element 32).
6. **As per claim 3**, the combination of Dussud/AAPA discloses the write-watch mechanism operates within a memory manager (Dussud, col. 5, lines 35-36; Fig. 1, elements 28 and 32).

7. **As per claim 4**, the combination of Dussud/AAPA discloses the write-watch mechanism records a first access to a one of the plurality of memory locations (Dussud, col. 5, lines 42-45).
8. **As per claim 5**, the combination of Dussud/AAPA discloses the list comprises a bitmap and each bit within the bitmap corresponds to one of the plurality of cards (Dussud, col. 9, lines 3-9).
9. **As per claim 6**, the combination of Dussud/AAPA discloses the list of memory locations is maintained in response to a request from the ephemeral garbage collection process (Dussud, col. 5, lines 50-51; Fig. 1, element 30). *It should be noted that the "garbage collector" is analogous to the "garbage collection process."*
10. **As per claim 7**, the combination of Dussud/AAPA discloses resetting the list of memory locations (Dussud, col. 5, lines 52-55).
11. **As per claim 8**, the combination of Dussud/AAPA discloses the subset of cards corresponds to a number of cards that are tracked using a page of memory storing the card table (Dussud, col. 5, lines 64-67; Fig. 1, element 34). *It should be noted that "memory portion" is analogous to the "memory storing the card table."*
12. **As per claim 9**, the combination of Dussud/AAPA discloses identifying the marked bundle comprises marking a bit associated with the marked bundle table within a bundle bitmap based on the memory locations within the list (AAPA, paragraph 0007; Dussud, col. 5, lines 42-45 and 50-51).
13. **As per claim 10**, the combination of Dussud/AAPA discloses marking the bit comprises setting the bit (AAPA, paragraph 0007).

14. **As per claim 11**, the combination of Dussud/AAPA discloses determining the at least one marked card comprises scanning a card bitmap having a bit for each of the plurality of cards, the bit for each marked card being different than another bit associated with one of the cards that was not accessed (Dussud, col. 9, lines 3-9; AAPA, paragraph 0007).

15. **As per claim 12**, Dussud discloses a method for executing statements within a program to support ephemeral garbage collection (col. 8, lines 46-53; Fig. 3), the method comprising:

specifying a range of card table memory to watch during program execution by calling a write-watch mechanism that performs tracking of the accesses to card table memory and maintains a write-watch list that identifies cards accessed within the card table memory since a garbage collection process was last performed (col. 8, line 65 – col. 9, line 11; Fig. 2, element 204; col. 5, lines 42-50), the card table memory identifying prior access to a plurality of cards, each card being associated with and update upon access to one or more objects allocated within the memory heap, the memory heap being divided into the plurality of cards, a subset of that plurality of cards that are tracked using a page of card table memory that are tracked using a page of card table memory (col. 5, line 64 – col. 6, line 1; Fig. 1, elements 34 and 36a-36i); *It should be noted that the “memory portion” is analogous to the “card table memory.”*

storing a value at a memory location within the heap memory based on the stored statement, marking one of the plurality of cards within the card table memory based on the memory location (col. 9, lines 3-9; Fig. 3, element 204);



tracking access to the card table memory (col. 8, line 65 – col. 9, line 11; Fig. 3, element 204; col. 5, lines 42-45).

Dussud does not disclose each card being grouped into one of a plurality of bundles, wherein each of the plurality of bundles corresponds to a subset of that plurality of cards;

creating one or more bundle tables containing entries identifying groupings of the cards in the plurality of bundles for each stored statement within the program;

updating at least one bundle table by marking the entries in the bundle table based on information obtained from the write-watch list, wherein the updated marked bundle table identifies groupings the plurality of marked cards having associated objects that have been accessed since a last garbage collection process;

for each marked bundle table, determining at least one marked card in a grouping of the plurality of marked cards identified by the marked bundle table;

for each marked card, determining at least one accessed object associated with the marked card.

AAPA discloses each card being grouped into one of a plurality of bundles, wherein each of the plurality of bundles corresponds to a subset of that plurality of cards (paragraph 0007);

creating one or more bundle tables containing entries identifying groupings of the cards in the plurality of bundles for each stored statement within the program (paragraph 0007);

wherein the updated marked bundle table identifies groupings the plurality of marked cards having associated objects that have been accessed since a last garbage collection process (paragraph 0007);

for each marked bundle table, determining at least one marked card in a grouping of the plurality of marked cards identified by the marked bundle table (paragraph 0007);

for each marked card, determining at least one accessed object associated with the marked card (paragraph 0007).

Dussud and AAPA are analogous art because they are from the same field of endeavor, that being garbage collection systems.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to apply AAPA's card table/bundle garbage collection process, a known technique, to Dussud's concurrent garbage collection, a known system ready for improvement, such that the combined garbage collection system would update at least one bundle table by marking the entries in the bundle table based on information obtained from the write-watch list, so as to yield the predictable results of improving the efficiency of ephemeral garbage collection as well helping minimize the dependency of ephemeral garbage collection on heap size.

16. **As per claim 14**, the combination of Dussud/AAPA discloses the write-watch mechanism resides within a memory manager and sets bits in the card table upon access to at least one of the plurality of cards (Dussud, col. 5, lines 35-36; col. 9, lines 1-9; Fig. 1, elements 28 and 32).

17. **As per claim 17**, the combination of Dussud/AAPA discloses an ephemeral garbage collection process requests the list when performing a garbage collection cycle (Dussud, col. 5, lines 50-51; Fig. 1, element 30).

18. **As per claim 18**, the combination of Dussud/AAPA discloses the ephemeral garbage collection process determines a marked bundle based on the write-watch list (AAPA, paragraph 0007; Dussud, col. 5, lines 42-45). *See the rejection of claim 12 above. It should be noted that when combining Dussud and AAPA as set forth in the rejection of claim 12 above, any markings to AAPA's bundle table would be based on Dussud's array of memory locations.*

19. **As per claim 19**, Dussud discloses a system for performing ephemeral garbage collection, the system comprising:

a processor (col. 7, line 1; Fig. 2, element 104);

and a memory into which a plurality of instructions are loaded (col. 7, lines 35-39; Fig. 2, element 106) and into which a plurality of objects are dynamically allocated, the memory having a heap into which the objects are allocated, the heap being divided into a plurality of cards, each card being associated with one or more of the plurality of objects (col. 5, line 64 – col. 6, line 1; Fig. 1, elements 34 and 36a-36i);

wherein upon execution of the plurality of instructions by the processor, the system being configured to:

request a list from a tracking mechanism (col. 5, lines 50-51; Fig. 1, element 32), the list only identifying memory locations that have been written into since a last garbage collection cycle (col. 5, lines 42-45; col. 6, lines 34-44), each memory location

corresponding to one of the plurality of cards associated with a card table, wherein the card table identifies one or more cards that have been accessed (col. 9, lines 3-9);

and perform garbage collection upon the one or more accessed objects (col. 11, lines 42-53; Fig. 4, element 318).

Dussud does not disclose creating one or more bundle tables wherein each bundle table identifies groupings of the plurality of cards in the plurality of bundles;

updating at least one bundle table by marking bundles within the bundle table based on the list, wherein the marked bundles corresponds to marked cards having associated objects that have been accessed since a last garbage collection process;

determine, for each marked bundle within the bundle table, at least one marked card within the marked bundle, the at least one marked card indicating that one or more objects associated with the marked card have been accessed;

determine, for each marked card, the one or more objects that have been accessed.

AAPA discloses creating one or more bundle tables wherein each bundle table identifies groupings of the plurality of cards in the plurality of bundles (paragraph 0007);

wherein the marked bundles corresponds to marked cards having associated objects that have been accessed since a last garbage collection process (paragraph 0007);

determine, for each marked bundle within the bundle table, at least one marked card within the marked bundle, the at least one marked card indicating that one or more objects associated with the marked card have been accessed (paragraph 0007);

determine, for each marked card, the one or more objects that have been accessed (paragraph 0007).

Dussud and AAPA are analogous art because they are from the same field of endeavor, that being garbage collection systems.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to apply AAPA's card table/bundle garbage collection process, a known technique, to Dussud's concurrent garbage collection, a known system ready for improvement, such that the combined garbage collection system would update at least one bundle table by marking bundles within the bundle table based on the list, so as to yield the predictable results of improving the efficiency of ephemeral garbage collection as well helping minimize the dependency of ephemeral garbage collection on heap size.

20. **As per claim 20**, the combination of Dussud/AAPA discloses the tracking mechanism comprises a write-watch mechanism (Dussud, col. 5, lines 50-51; Fig. 1, element 32).

21. **As per claim 21**, the combination of Dussud/AAPA discloses the write-watch mechanism resides within a memory manager and sets bits in the card table upon access to at least one of the plurality of cards (Dussud, col. 5, lines 35-36; col. 9, lines 1-9; Fig. 1, elements 28 and 32).

22. **As per claim 22**, the combination of Dussud/AAPA discloses the subset of cards corresponds to a number of cards that are tracked using a page of memory storing the card table (Dussud, col. 5, lines 64-67; Fig. 1, element 34).

23. **As per claim 23**, the combination of Dussud/AAPA discloses the marked bundle being identified by a marked bit associated with the marked bundle within a bundle bitmap based on the list (AAPA, paragraph 0007; Dussud, col. 5, lines 42-45). *See the rejection of claim 19 above. It should be noted that when combining Dussud and AAPA as set forth in the rejection of claim 19 above, any markings to AAPA's bundle table would be based on Dussud's array of memory locations.*
24. **As per claim 24**, the combination of Dussud/AAPA discloses setting a bit in the card table to identify one or more cards that have been accessed (Dussud, col. 9, lines 7-9).

#### **Response to Arguments**

25. Applicant's arguments with respect to **claims 1-12, 14, and 17-24** have been considered but are moot in view of the new ground of rejection above.

#### **Conclusion**

#### **STATUS OF CLAIMS IN THE APPLICATION**

The following is a summary of the treatment and status of all claims in the application as recommended by MPEP 707.70(i):

#### **CLAIMS REJECTED IN THE APPLICATION**

Per the instant office action, **claims 1-12, 14, and 17-24** have received a first action on the merits and are subject of a first action non-final.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arpan P. Savla whose telephone number is (571) 272-1077. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sanjiv Shah can be reached on (571) 272-4098. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Arpan Savla/  
Examiner, Art Unit 2185  
December 5, 2008

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